What is claimed is:

[Claim 1] 1.A method of determining rotor position in a polyphase switched reluctance machine having a stator, a rotor and a plurality of phases of energizable windings, the method comprising:

receiving signals indicating current levels in the phase windings;
injecting diagnostic pulses into any of the phase windings where the current level is below a predetermined level; and
determining the rotor position relative to the stator from detected characteristics of the diagnostic pulses.

[Claim 2] 2.The method of claim 1, wherein injecting diagnostic pulses includes:

injecting a first diagnostic pulse into a first one of the phase windings during an active period of the first phase when the current in the phase winding is below a predetermined level; and
injecting a second diagnostic pulse into a second one of the phase windings during an inactive period of the second phase.

[Claim 3] 3.The method of claim 2, wherein the first and second diagnostic pulses are injected substantially simultaneously.

[Claim 4] 4.The method of claim 1, wherein the diagnostic pulses have a predetermined maximum value of current.

[Claim 5] 5.The method of claim 1, wherein the diagnostic pulses have a predetermined maximum value of flux linkage.

[Claim 6] 6.The method of claim 1, wherein the diagnostic pulses are injected by switching a supply voltage across the phase winding.

[Claim 7] 7.The method of claim 2, wherein the switched reluctance machine is a three-phase machine.

[Claim 8] 8.The method of claim 7, further comprising injecting a third diagnostic pulse into a third one of the phase windings during an inactive period of the third phase.

[Claim 9] 9.The method of claim 8, wherein the first, second and third diagnostic pulses are injected substantially simultaneously.

[Claim 10] 10.The method of claim 1, wherein determining the rotor position includes weighting the detected characteristics of the diagnostic pulses in response to an estimated position of the rotor.

[Claim 11] 11.The method of claim 10, wherein the detected characteristics are weighted according to

$$\frac{(w_a\theta_a + w_b\theta_b + w_c\theta_c)}{(w_a + w_b + w_c)}$$

where θ is the position estimated from the respective phase and w is the weighting based on that position estimate.

[Claim 12] 12.The method of claim 1, wherein injecting diagnostic pulses includes subtracting the current value present in the phase winding prior to the injection of the diagnostic pulses.

[Claim 13] 13.A switched reluctance machine system, comprising:

a stator;
a rotor situated to rotate relative to the stator;
a plurality of phase windings situated in the stator;
a power converter;
a power supply connected to the phase windings via the power converter; and
a controller outputting control signals to the power converter to selectively apply power to the phase windings, the controller receiving signals from the phase windings providing current feedback;
the controller being programmed to analyze the phase current feedback and control the power converter to inject diagnostic pulses into any of the phase windings in which current is below a predetermined level to determine the position of the rotor relative to the stator.

[Claim 14] 14.The switched reluctance machine system of claim 13, wherein the controller is programmed to inject a first diagnostic pulse into a first one of the phase windings during an active period of the first phase when the current in the phase winding is below a predetermined level, and inject a second diagnostic pulse into a second one of the phase windings during an inactive period of the second phase.

[Claim 15] 15.The switched reluctance machine system of claim 14, wherein the switched reluctance machine is a three-phase machine.

[Claim 16] 16.The switched reluctance machine system of claim 15, wherein the controller is programmed to inject a third diagnostic pulse into a third one of the phase windings during an inactive period of the third phase.

[Claim 17] 17.The switched reluctance machine system of claim 16, wherein the controller is programmed to inject the first, second and third diagnostic pulses substantially simultaneously.

[Claim 18] 18.The switched reluctance machine system of claim 16, wherein the controller is programmed to determine the rotor position based on detected characteristics of the first, second and third diagnostic pulses.

[Claim 19] 19.The switched reluctance machine system of claim 14, wherein the controller is programmed to weight the detected characteristics of the first and second pulses in response to an estimated position of the diagnostic pulses.

[Claim 20] 20.The switched reluctance machine system of claim 19, wherein the controller is programmed to weight the detected characteristics according to

$$\frac{(w_a\theta_a + w_b\theta_b + w_c\theta_c)}{(w_a + w_b + w_c)}$$

where θ is the position estimated from the respective phase and w is the weighting based on that position estimate.

[Claim 21] 21.The switched reluctance machine system of claim 13, wherein the controller is programmed to subtract the current level present in the windings prior to the injection of the diagnostic pulses.

[Claim 22] 22.A control system for a switched reluctance machine having a stator, a rotor situated to rotate relative to the stator, a plurality of phase windings situated in the stator, a power converter, and a power supply connected to the phase windings via the power converter, the control system comprising:

output terminals for providing control signals to the power converter to selectively apply power to the phase windings; and

input terminals for receiving current feedback signals from the phase windings; and
a controller connected to the input and output terminals, the controller being programmed to analyze the phase current information and control the power converter to inject diagnostic pulses into any of the phase windings when the current in the phase winding is below a predetermined level to determine the position of the rotor relative to the stator.

[Claim 23] 23.The control system of claim 22, wherein the controller is programmed to inject a first diagnostic pulse into a first one of the phase windings during an active period of the first phase when the current in the phase winding is below a predetermined level, and inject a second diagnostic pulse into a second one of the phase windings during an inactive period of the second phase.

[Claim 24] 24.The control system of claim 23, wherein the controller is programmed to inject a third diagnostic pulse into a third one of the phase windings during an inactive period of the third phase.

[Claim 25] 25.The control system of claim 24, wherein the controller is programmed to determine the rotor position based on detected characteristics of the first, second and third diagnostic pulses.

[Claim 26] 26.The control system of claim 23, wherein the controller is programmed to weight the detected characteristics of the diagnostic pulses in response to an estimated position of the rotor.

[Claim 27] 27.The control system of claim 26, wherein the controller is programmed to weight the detected characteristics according to

$$\frac{(w_a\theta_a + w_b\theta_b + w_c\theta_c)}{(w_a + w_b + w_c)}$$

where θis the position estimated from the respective phase and w is the weighting based on that position estimate.

[Claim 28] 28.The control system of claim 23, wherein the controller is programmed to subtract the current level present in the phase winding prior to the injection of the diagnostic pulse.